

CHAPTER SEVEN

TRANSMISSION AND INTERNAL
SHIFT MECHANISM

This chapter describes service to the forward and reverse transmission assemblies identified in **Figure 1**:

1. Mainshaft (A).
2. Reverse idle gear assembly (B).
3. Countershaft (C).
4. Shift drum (D).
5. Shift fork shaft and shift forks (E).

All TRX250EX models use a 5-speed transmission with reverse. The engine must be removed and the crankcase disassembled (Chapter Five) to service the transmission and internal shift mechanism.

When inspecting transmission components, compare measurements to the specifications in **Tables 1-5**. Replace any component that is damaged, worn to the service limit or out of specification. During assembly, tighten fasteners as specified.

Tables 1-6 are at the end of this chapter.

TRANSMISSION OVERHAUL

Removal/Installation

Remove and install the transmission and internal shift assemblies as described in *Crankcase and Crankshaft* in Chapter Five.

Preliminary Inspection

After the transmission shaft assemblies have been removed from the crankcase, clean and inspect each assembly before disassembling it. Place a shaft assembly into a large can or plastic bucket, and thoroughly clean the assembly with a stiff brush and a petroleum-based solvent, such as kerosene. Dry the assembly with compressed air, or let it drip dry on rags.

1. After the shaft assemblies have been cleaned, visually inspect the components of each assembly for excessive wear. Any burrs, pitting or roughness on

the teeth of a gear causes wear on its mated gear. Minor roughness can be cleaned up with an oilstone, but there is little point in attempting to remove deep scars.

CAUTION

Replace defective gears. It is best to replace its mated gear on the other shaft as well, even though the mate may not show as much wear or damage.

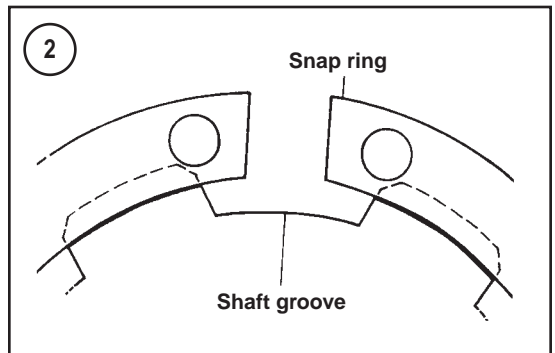
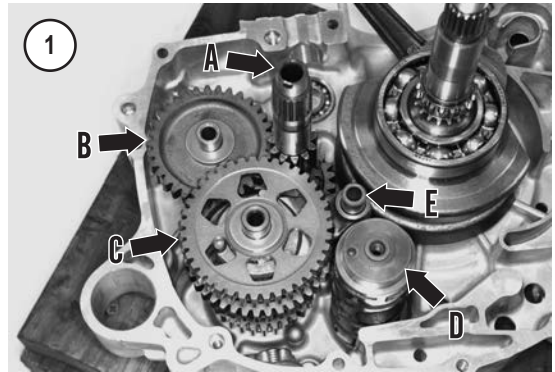
2. Carefully check the engagement dogs. If any is chipped, worn, rounded or missing, replace the affected gear.
3. Rotate the transmission bearings by hand. Check for roughness, noise and radial play. Replace any suspect bearing.
4. If the transmission assemblies are in satisfactory condition and are not being disassembled, apply assembly or engine oil to all components, and reinstall the assemblies into the crankcase as described in Chapter Five.

NOTE

Watch for any additional shims not shown in the illustrations or photographs. During a previous repair additional shims may have been installed to take up excess clearance created by worn components. If the transmission is being reassembled with the old parts, install these shims in their original locations because the shims have developed a wear pattern. If new parts are being used, discard the additional shims.

Service Notes

1. As each part is removed from its shaft, set it in an egg crate in the exact order of removal and with the same orientation it had when installed on the shaft.
2. The snap rings fit tightly on the transmission shafts. Replace all snap rings during assembly.
3. Snap rings turn and fold over making removal and installation difficult. To ease the removal, open a snap ring with a pair of snap ring pliers. At the same time grasp the back of the snap ring with another pair of pliers, and slide the snap ring off the shaft. Repeat this process during installation.



4. When installing a snap ring, align the end gap in the snap ring with a groove in the shaft (**Figure 2**).
5. When installing a bushing, align the hole in the bushing with the oil hole in the shaft.

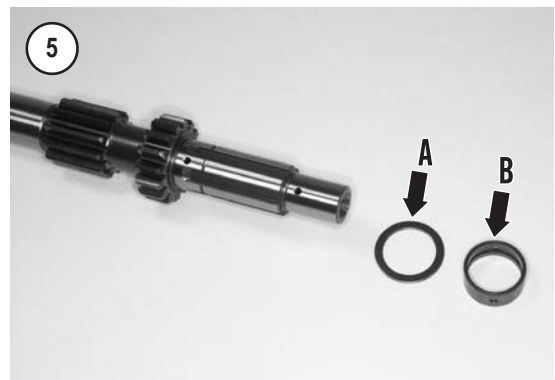
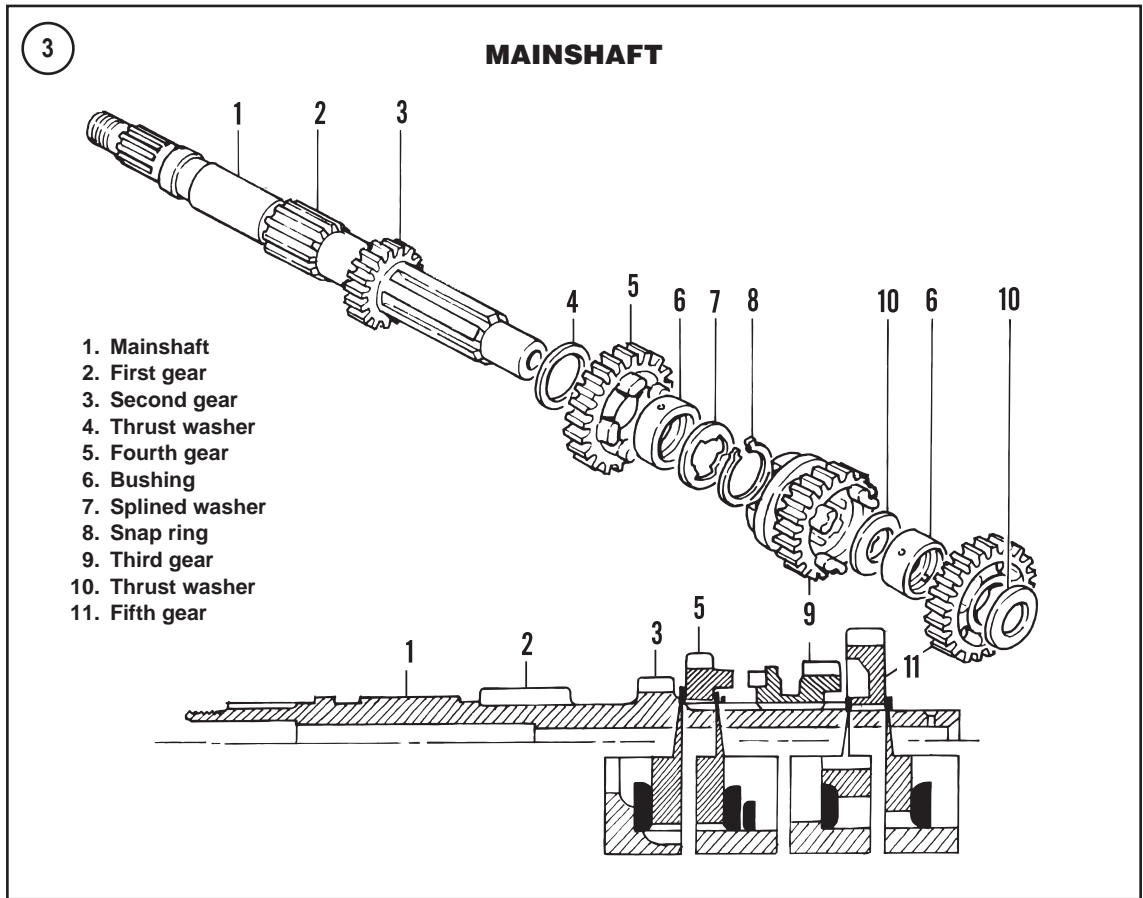
Mainshaft Disassembly

Refer to **Figure 3**.

1. Clean and dry the assembled mainshaft (**Figure 4**).
2. Remove the thrust washer.
3. Remove fifth gear and its bushing.
4. Remove the second thrust washer.
5. Remove third gear.
6. Remove the snap ring and splined washer. Discard the snap ring.
7. Remove fourth gear and its bushing.
8. Remove the thrust washer.

NOTE

Mainshaft second and first gears are an integral part of the mainshaft. They cannot be removed.



9. Inspect the mainshaft assembly as described in *Transmission Inspection* in this chapter.

Mainshaft Assembly

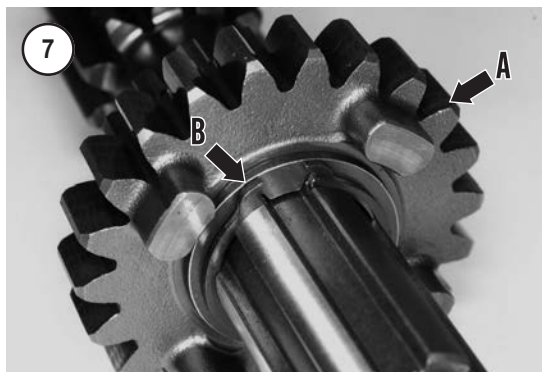
Refer to **Figure 3**.

1. Lubricate all sliding surfaces with engine oil.

2. Install the thrust washer (A, **Figure 5**) and slide it against second gear. The flat side of the thrust washer must face in toward second gear.

3. Align the hole in the fourth gear bushing (B, **Figure 5**) with the oil hole in the mainshaft, and slide the bushing up against the thrust washer (**Figure 6**).

4. Install fourth gear over the shaft and onto the fourth gear bushing. The gear's engagement dogs



must face out away from second gear as shown in A, **Figure 7**.

5. Install the splined washer (A, **Figure 8**) and slide it against fourth gear. The flat side of the washer must face away from fourth gear.

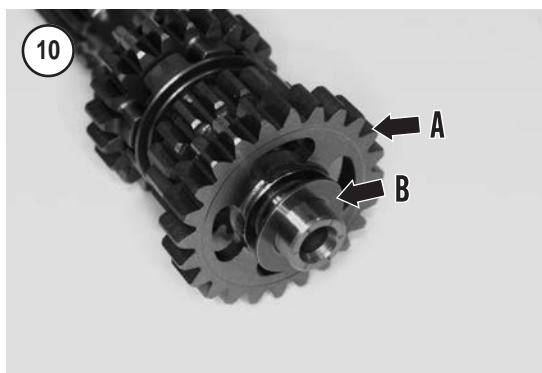
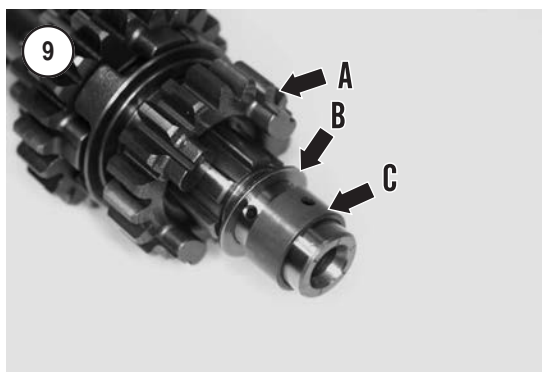
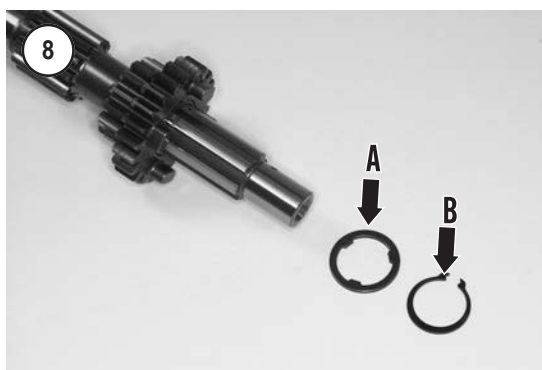
6. Install a new snap ring (B, **Figure 8**) so its flat side faces away from the splined washer. Seat the snap ring in the snap ring groove, and rotate the snap ring as necessary so its end gap aligns with a shaft groove. Refer to B, **Figure 7**.

7. Install third gear (A, **Figure 9**) so its shift fork groove faces toward fourth gear.

8. Install the thrust washer (B, **Figure 9**) so its flat side faces toward third gear and install the fifth gear bushing (C).

9. Install fifth gear (A, **Figure 10**) onto the bushing so the flat side of the gear faces away from third gear.

10. Install the thrust washer (B, **Figure 10**) so its flat side faces away from fifth gear.



Countershaft Disassembly

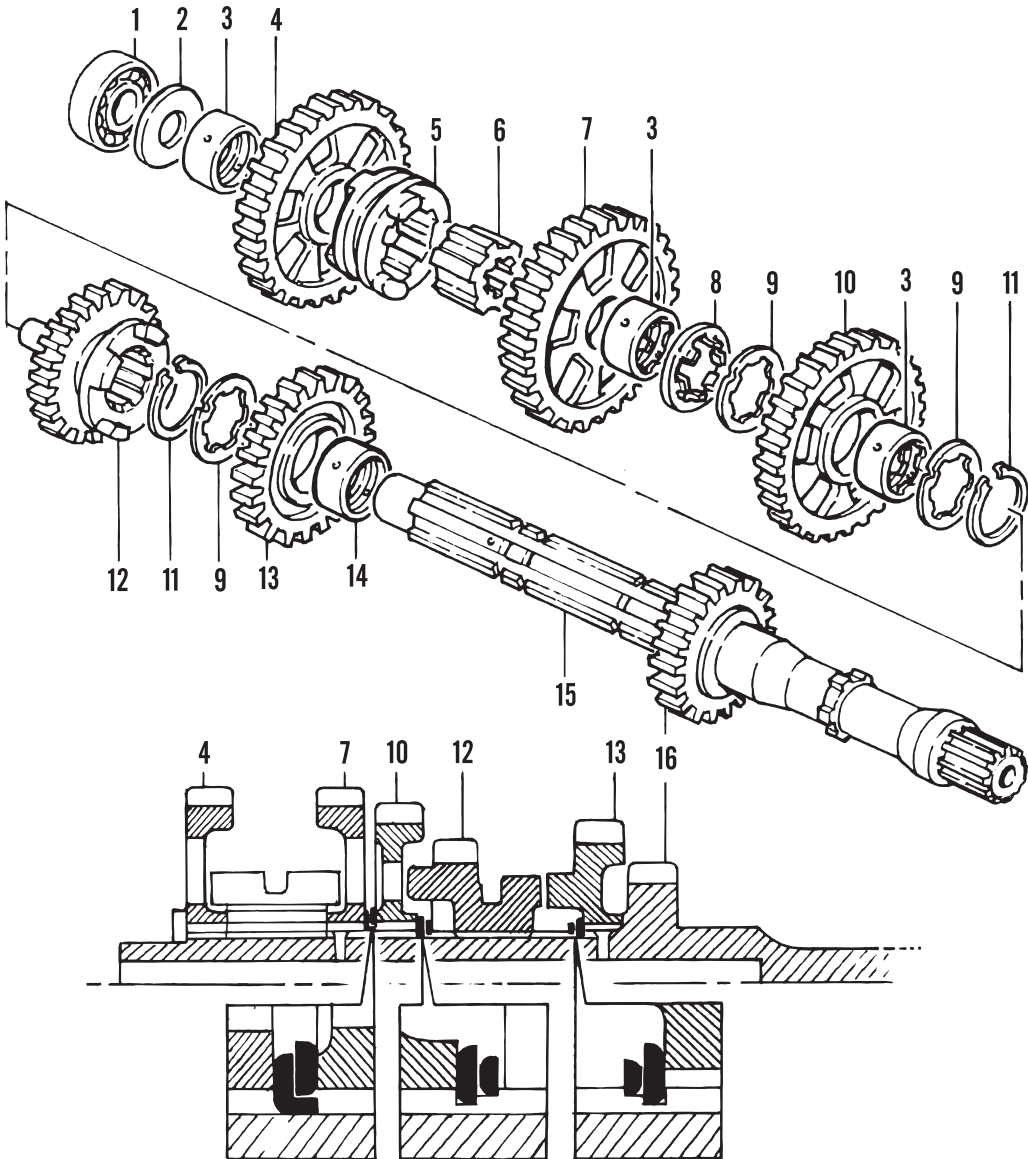
A number of parts on the countershaft are symmetrical. This means they can be installed with either side facing in either direction. However, on a used transmission, a wear pattern develops on some of these parts. To prevent excessive wear or transmission noise after assembly, mark the spline collar, reverse shifter and spline bushings with a grease pencil so they can be installed in their original operating positions.

Refer to **Figure 11**.

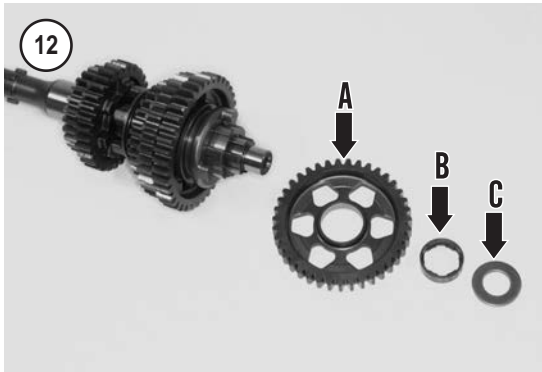
NOTE

*The countershaft first gear (A, **Figure 12**), first gear bushing (B) and thrust*

11

COUNTERSHAFT

- | | |
|--------------------|-------------------|
| 1. Bearing | 9. Splined washer |
| 2. Thrust washer | 10. Second gear |
| 3. Splined bushing | 11. Snap ring |
| 4. First gear | 12. Fourth gear |
| 5. Reverse shifter | 13. Third gear |
| 6. Splined collar | 14. Bushing |
| 7. Reverse gear | 15. Countershaft |
| 8. Lock washer | 16. Fifth gear |



washer (C) were removed during transmission removal (Chapter Five).

1. Clean and dry the assembled countershaft (**Figure 13**).
2. Remove the reverse shifter and its splined collar.
3. Remove the reverse gear and its splined bushing.
4. Disengage the lockwasher teeth from the splined washer. Remove the lockwasher and the splined washer.
5. Remove the second gear and its splined bushing.
6. Remove the splined washer and snap ring. Discard the snap ring.
7. Remove fourth gear.
8. Remove and discard the snap ring, and then remove the splined washer.
9. Remove third gear and its bushing.

NOTE

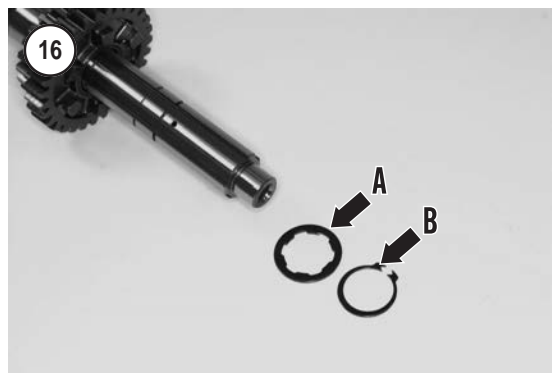
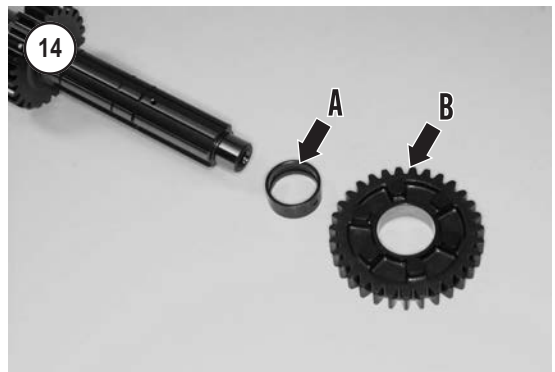
Fifth gear is an integral part of the countershaft. It cannot be removed.

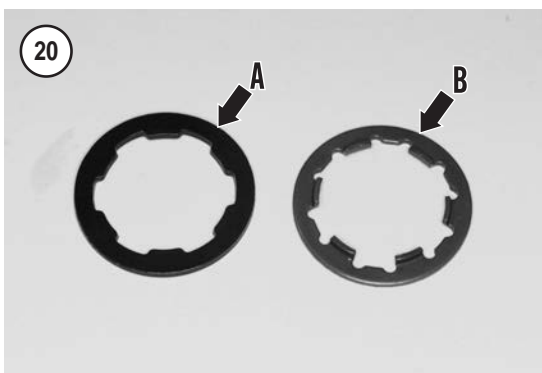
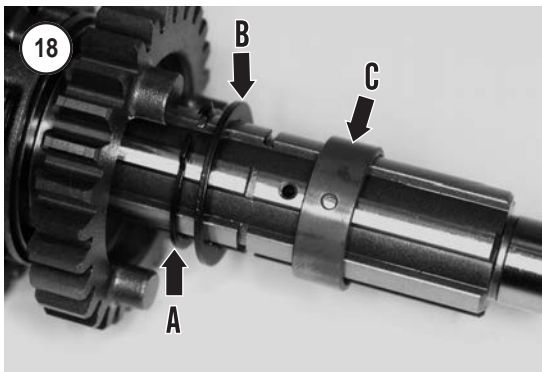
10. Inspect the countershaft assembly as described in *Transmission Inspection* in this chapter.

Countershaft Assembly

Refer to **Figure 11**.

1. Lubricate all sliding surfaces with engine oil.
2. Install the third gear bushing (A, **Figure 14**) onto the countershaft, and slide the bushing against fifth gear.
3. Install third gear (B, **Figure 14**) onto the countershaft and over the third gear bushing. The engagement dogs on third gear must face away from fifth gear. Refer to A, **Figure 15**.





4. Install the splined washer (A, **Figure 16**), and slide it against third gear. The flat side of the splined washer must face away from third gear.

5. Install a new snap ring (B, **Figure 16**) and seat it in the snap ring groove next to the third gear splined washer. The flat side of the snap ring must face away from the washer. Rotate the snap ring as necessary so its end gap aligns with a groove in the shaft. Refer to B, **Figure 15**.

6. Install fourth gear (**Figure 17**) so the side with the shift fork groove faces toward third gear.

7. Install a new snap ring (A, **Figure 18**) and seat it in the snap ring groove closest to fourth gear. The flat side of the snap ring must face in toward fourth gear, and the snap ring end gap must align with a groove in the countershaft (**Figure 2**).

8. Install a splined washer (B, **Figure 18**), and slide it against the snap ring. The flat side of splined washer must face toward the snap ring.

9. Align the hole in the second gear splined bushing (C, **Figure 18**) with the oil hole in the countershaft, and slide the bushing against the splined washer.

10. Install second gear (**Figure 19**), and seat it onto the second gear splined bushing. The flat side of the gear must face away from fourth gear.

11. Install the lockwasher assembly by performing the following:

- a. Install the splined washer (A, **Figure 20**) onto the countershaft and seat it against second gear.
- b. Rotate the splined washer (**Figure 21**) so its splines align with the countershaft splines.
- c. Position the lockwasher (B, **Figure 20**) with its teeth pointing toward the splined washer.

- d. Slide the lockwasher over the countershaft, and insert its teeth into the grooves in the splined washer (**Figure 22**).
12. Align the hole in the reverse gear splined bushing (**Figure 23**) with the oil hole in the countershaft, and slide the bushing against the lockwasher assembly.
13. Install the reverse gear (A, **Figure 24**) onto the shaft, and seat the gear on the bushing. The flat side of reverse gear must face toward second gear.
14. Install the splined collar (B, **Figure 24**) onto the countershaft, and seat it against the reverse gear.
15. Install the reverse shifter (**Figure 25**). Make sure its engagement dogs properly engage the reverse gear.
16. The countershaft assembly is complete. First gear (A, **Figure 12**), the first gear bushing (B) and the thrust washer (C) are installed during transmission installation (Chapter Five).

REVERSE IDLE GEAR ASSEMBLY

Disassembly/Assembly

1. The reverse idle gear assembly (**Figure 26**) is disassembled when it is removed from the crankcase. Follow the procedure described in *Crankcase and Crankshaft* in Chapter Five.
2. Clean the reverse idle gear components in solvent. Dry them with compressed air.
3. Inspect the reverse idle gear assembly as described in *Transmission Inspection* in this chapter.

NOTE

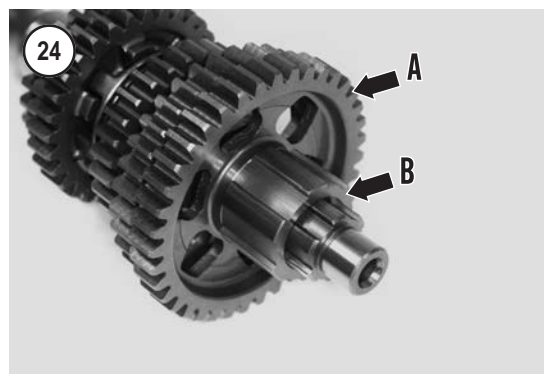
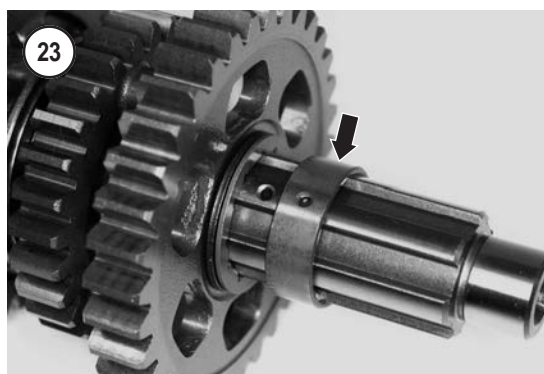
*During crankcase assembly, install both thrust washers with their chamfered sides facing toward the reverse idle gear. Refer to **Figure 26**.*

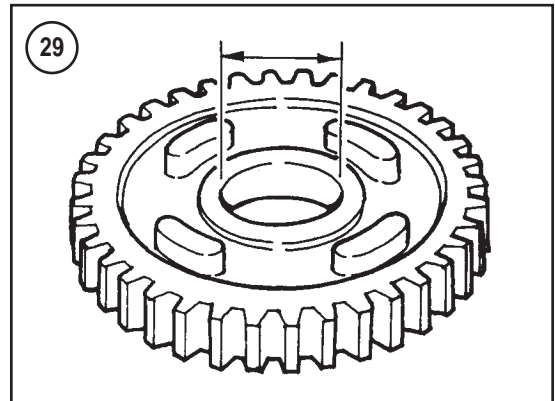
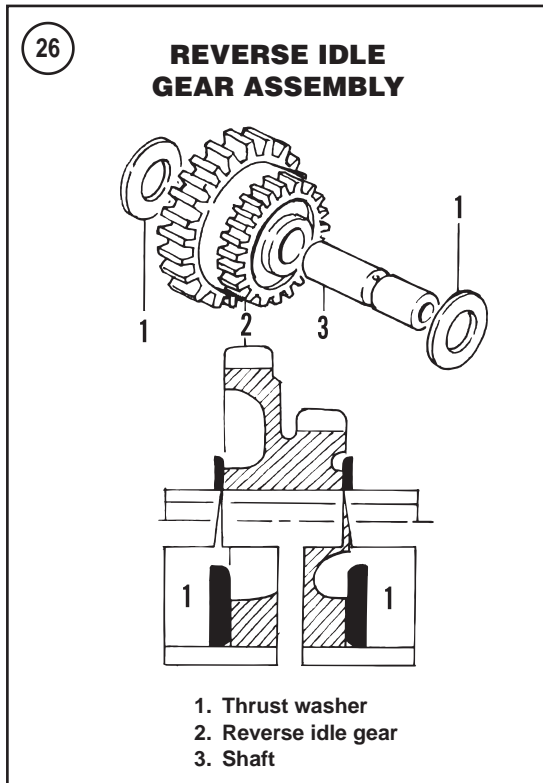
4. The reverse idle gear assembly is assembled when installed into the crankcase. Follow the procedures in *Crankcase and Crankshaft* in Chapter Five.

TRANSMISSION INSPECTION

Mainshaft

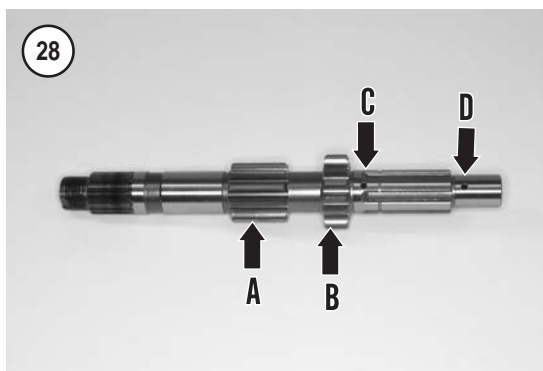
When inspecting mainshaft components (**Figure 27**), compare measurements to the mainshaft specifications in **Table 2** at the end of this chapter. Re-





place parts that are damaged or out of specification. When replacing a gear, also replace its mated gear on the countershaft, even though the mate may not show as much wear or damage.

1. Clean and dry the mainshaft components. Flush the shaft and bushing oil holes with compressed air.
2. Inspect the mainshaft (**Figure 28**) for:
 - a. Worn or damages splines.
 - b. Missing, broken or chipped first (A, **Figure 28**) and second (B) gear teeth.
 - c. Excessively worn or damaged bearing surfaces.
 - d. Cracked or rounded-off snap ring groove.
 - e. Plugged oil holes.
3. Check each mainshaft gear (**Figure 27**) for:
 - a. Missing, broken or chipped teeth.
 - b. Worn, damaged or rounded engagement dogs.
 - c. Worn or damaged splines.
 - d. Cracked or scored gear bore.
4. Check each mainshaft bushing for:
 - a. Excessively worn or damaged bearing surfaces.
 - b. Worn or damaged splines.
 - c. Cracked or scored gear bore.
5. Measure the mainshaft outside diameter at the fourth (C, **Figure 28**) and fifth (D) gear operating positions, and record the dimensions.
6. Measure the inside diameter of the mainshaft fourth and fifth gears (**Figure 29**), and record the dimensions.
7. Measure the inside and outside diameters of the mainshaft fourth- and fifth-gear bushings (**Figure 30**), and record the dimensions.

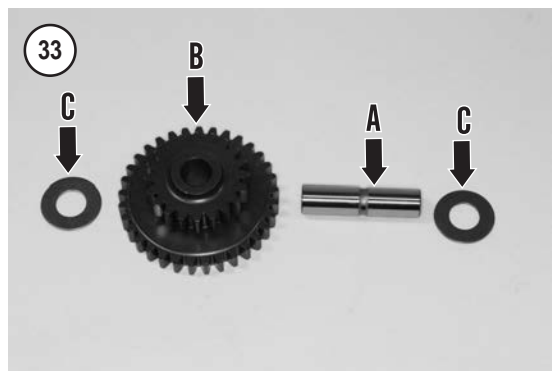
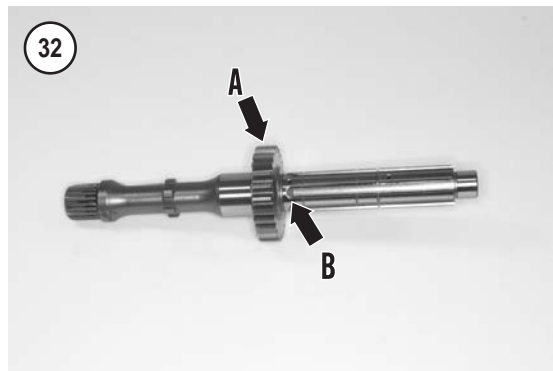
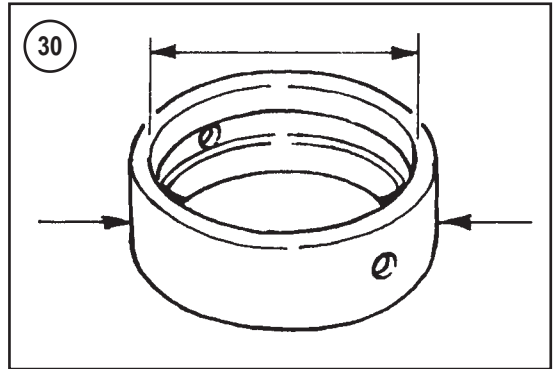


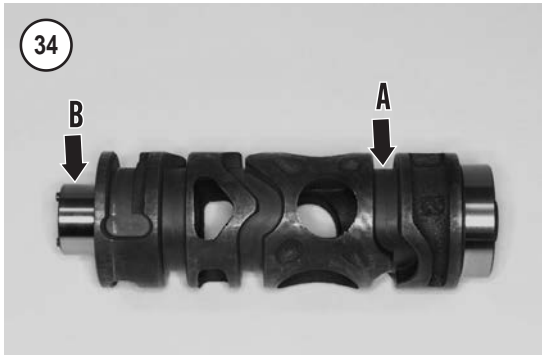
8. Determine the gear-to-bushing clearance by subtracting a bushing outside diameter (Step 7) from its related gear's inside diameter (Step 6).
9. Determine the bushing-to-shaft clearance by subtracting a mainshaft outside diameter (Step 5) from the related bushing's inside diameter (Step 7).

Countershaft

When inspecting countershaft components (**Figure 31**), compare measurements to the countershaft specifications in **Table 3**. Replace parts that are damaged or out of specification. When replacing a gear, also replace its mated gear on the mainshaft even though the mate may not show as much wear or damage.

1. Clean and dry the countershaft components. Flush the shaft and bushing oil holes with compressed air.
2. Inspect the countershaft (**Figure 32**) for:
 - a. Worn or damaged splines.
 - b. Missing, broken or chipped fifth gear teeth (A, **Figure 32**).
 - c. Excessively worn or damaged bearing surfaces.
 - d. A cracked or rounded-off snap ring groove.
 - e. Plugged oil holes.
3. Check each countershaft gear (**Figure 31**) for:
 - a. Missing, broken or chipped teeth.
 - b. Worn, damaged or rounded engagement dogs.
 - c. Worn or damaged splines.
 - d. A cracked or scored gear bore.
4. Check each countershaft bushing for:
 - a. Excessively worn or damaged bearing surfaces.
 - b. Worn or damaged splines.
 - c. A cracked or scored gear bore.
5. Inspect the reverse shifter for worn, damaged or rounded engagement dogs. Check the splines for excessive wear or damage.
6. Inspect the splined collar for excessive wear or damage.
7. Measure the inside diameter of the countershaft first, second, third and reverse gears (**Figure 29**). Record the dimensions.
8. Measure the outside diameter of the countershaft first-, second-, third- and reverse-gear bushings (**Figure 30**). Record the dimensions.





9. Determine the gear-to-bushing clearances by subtracting the bushing's outside diameter (Step 8) from its related gear's inside diameter (Step 7).

10. Measure the countershaft outside diameter at the third gear operating position (B, **Figure 32**), and record the dimension.

11. Measure the inside diameter of the countershaft third gear bushing (**Figure 30**), and record the dimension.

12. Determine the bushing to shaft clearance by subtracting the countershaft outside diameter (Step

10) from the third-gear bushing inside diameter (Step 11).

Reverse Idle Gear

When inspecting reverse idle gear components (**Figure 33**), compare measurement to the specification in **Table 4** at the end of this chapter. Replace parts that are damaged or out of specification.

1. Clean and dry the reverse idle gear assembly.
2. Check the reverse idle gear shaft (A, **Figure 33**) for cracked, scored or damaged bearing surfaces.
3. Check the reverse idle gear (B, **Figure 33**) for:
 - a. Missing, broken or chipped teeth.
 - b. A cracked or scored gear bore.
4. Check each reverse idle gear thrust washer (C, **Figure 33**) for scoring or other signs of damage.
5. Measure the outside diameter of the reverse idle gear shaft, and record the dimension.
6. Measure the inside diameter of the reverse idle gear (**Figure 29**), and record the dimension.
7. Determine the gear-to-shaft clearance by subtracting the shaft outside diameter (Step 5) from the gear inside diameter (Step 6).

INTERNAL SHIFT MECHANISM

Removal/Installation

The internal shift mechanism is removed and installed with the transmission shaft assemblies. Perform the procedure described in Chapter Five.

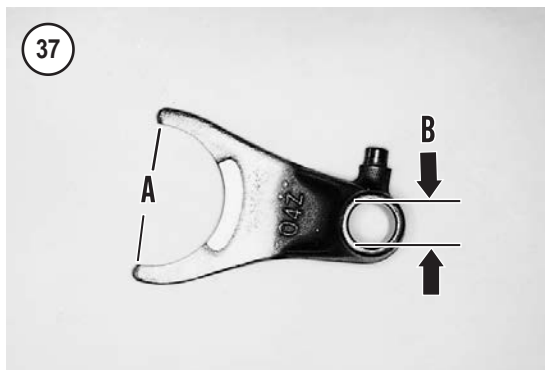
Shift Drum Inspection

1. Clean and dry the shift drum.
2. Check the shift drum for excessively worn or damaged guide pin grooves (A, **Figure 34**) or bearing surfaces (B). Replace the shift drum if necessary.
3. Inspect each pin on the end of the shift drum (**Figure 35**). Replace as necessary.

Shift Fork Inspection

During inspection, compare shift fork measurements to the specifications in **Table 5** at the end of this chapter. Replace parts that are damaged or out of specification.

1. Inspect each shift fork (**Figure 36**) for signs of wear or damage. Examine the shift forks fingers



where they contact the slider gear (A, **Figure 37**). These surfaces must be smooth with no signs of wear, bending, cracks, heat discoloration or other damage.

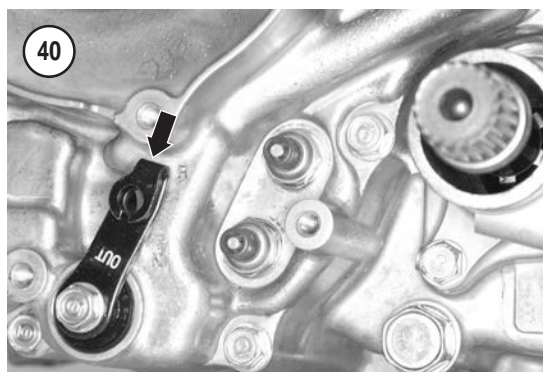
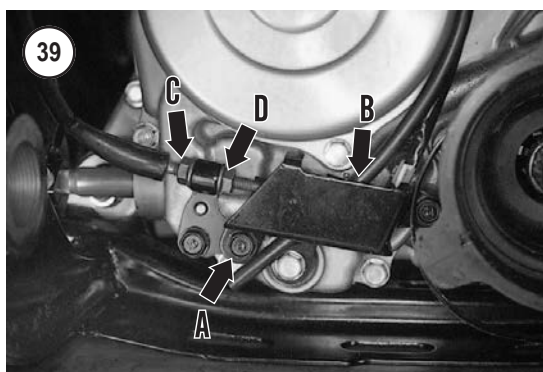
2. Check each shift fork for arc-shaped wear or burn marks. These marks indicate that the shift fork has contacted the gear.

3. Check the shift fork shaft for bending or other damage. Install each shift fork onto the shaft, and slide it back and forth. Each shift fork must slide smoothly with no binding or tight spots. If there is binding with all three shift forks, check the shaft closely for bending. If there is binding with only one shift fork, check the shift fork closely.

4. Measure each shift fork finger thickness (**Figure 38**).

5. Measure the shift fork inside diameter (B, **Figure 37**) with a small bore gauge. Measure the gauge with a micrometer.

6. Measure the shift fork shaft outside diameter at three different points on the shaft.



REVERSE SELECTOR CABLE REPLACEMENT

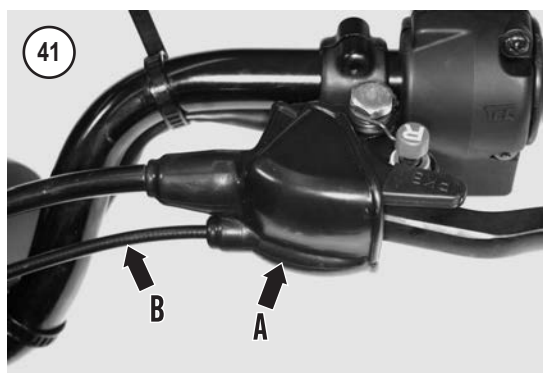
1. Remove the handlebar cover (Chapter Fourteen).

2. Remove the fuel tank as described in Chapter Eight.

3. Make a diagram of the reverse selector cable routing path from the handlebar to the reverse stopper lever.

4. Remove any cable guides from the reverse selector cable.

5. On the left side of the alternator cover, remove the mounting bolts (A, **Figure 39**) and cover (B) from the reverse stopper lever.



6. Loosen the cable locknut (C, **Figure 39**) and cable adjuster (D).
7. Disconnect the cable end from the reverse stopper lever (**Figure 40**), and release the cable from the bracket on the alternator cover.
8. At the handlebar, pull back the boot (A, **Figure 41**) and disconnect the reverse selector cable (B).
9. Remove the reverse selector cable. Note the path it follows.
10. Reverse these steps to install the reverse selector cable, plus the following:
 - a. Lubricate the new cable as described in Chapter Three.
 - b. Apply grease to the barrel connector at the cable end.
 - c. Adjust the reverse selector cable as described in Chapter Three.

Table 1 TRANSMISSION SPECIFICATIONS

Item	Specifications
Primary reduction ratio	3.087 (71/23)
Final reduction ratio	3.692 (48/13)
Transmission	5-speed plus reverse, constant mesh
Shift pattern	R-N-1-2-3-4-5
Gear ratios	
1st gear	2.846 (37/13)
2nd gear	1.933 (29/15)
3rd gear	1.444 (26/18)
4th gear	1.130 (26/23)
5th gear	0.913 (21/23)
Reverse	4.769 (31/16 × 32/13)

Table 2 MAINSHAFT SPECIFICATIONS

Item	New mm (in.)	Service limit mm (in.)
Gear inside diameter		
Fourth gear	23.000-23.021 (0.9055-0.9063)	23.04 (0.907)
Fifth gear	18.000-18.021 (0.7087-0.7095)	18.04 (0.710)
Mainshaft outside diameter		
Fourth gear	19.959-19.980 (0.7858-0.7866)	19.93 (0.785)
Fifth gear	14.966-14.984 (0.5892-0.5899)	14.94 (0.588)
Gear bushing		
Fourth gear		
Inside diameter	20.000-20.021 (0.7874-0.7882)	20.04 (0.789)
Outside diameter	22.959-22.979 (0.9039-0.9047)	22.94 (0.903)
Fifth gear		
Inside diameter	15.000-15.018 (0.5906-0.5913)	15.04 (0.592)
Outside diameter	17.959-17.980 (0.7070-0.7079)	17.94 (0.706)
Gear-to-bushing clearance		
Fourth gear	0.021-0.062 (0.0008-0.0024)	0.10 (0.004)
Fifth gear	0.020-0.062 (0.0008-0.0024)	0.10 (0.004)
Bushing-to-shaft clearance		
Fourth gear	0.020-0.062 (0.0008-0.0024)	0.10 (0.004)
Fifth gear	0.016-0.052 (0.0006-0.0024)	0.10 (0.004)

Table 3 COUNTERSHAFT SPECIFICATIONS

Item	New mm (in.)	Service limit mm (in.)
Gear inside diameter		
First, second, third and reverse gears	25.000-25.021 (0.9843-0.9851)	25.04 (0.986)
Gear bushing		
First, second and reverse gears		
Outside diameter	24.959-24.980 (0.9826-0.9835)	24.94 (0.982)
Third gear		
Inside diameter	22.000-22.021 (0.8661-0.8670)	22.04 (0.868)
Outside diameter	24.959-24.980 (0.9826-0.9835)	24.94 (0.982)
Gear-to-bushing clearance		
First, second, third and reverse gears	0.020-0.062 (0.0008-0.0024)	0.10 (0.004)
Bushing-to-shaft clearance		
Third gear	0.020-0.062 (0.0008-0.0024)	0.10 (0.004)

Table 4 REVERSE IDLE GEAR SPECIFICATIONS

Item	New mm (in.)	Service limit mm (in.)
Reverse idle gear shaft outside diameter	12.996-12.984 (0.5105-0.5112)	12.94 (0.509)
Gear inside diameter	13.000-13.018 (0.5118-0.5125)	13.04 (0.513)
Gear-to-shaft clearance	0.016-0.052 (0.0006-0.0020)	0.10 (0.004)

Table 5 SHIFT FORK SPECIFICATIONS

Item	New mm (in.)	Service limit mm (in.)
Shift fork finger thickness	4.93-5.00 (0.194-0.197)	4.60 (0.181)
Shift fork inside diameter	13.000-13.021 (0.5118-0.5126)	13.04 (0.513)
Shift fork shaft outside diameter	12.996-12.984 (0.5105-0.5112)	12.96 (0.510)

Table 6 TRANSMISSION TORQUE SPECIFICATIONS

Item	N•m	in.-lb.	ft.-lb.
Gearshift A arm bolt	25	—	18
Shift cam plate bolt	16	—	12
Shift drum stopper arm bolt	12	106	—
Shift shaft return spring pin	22	—	16

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